

What is claimed is:

1. A valve timing adjustment device provided to a transmission system for transmitting drive torque from a drive shaft of an internal combustion engine to a driven shaft for opening and closing at least one of an air intake valve and an exhaust valve, adjusting the timing at which at least one of the air intake valve and the exhaust valve opens and closes, the device comprising:

a first rotor that rotates around a rotation centerline by the drive torque from the drive shaft;

a second rotor that rotates around the rotation centerline together with the rotation of the first rotor and in the same direction as the first rotor so as to make the driven shaft rotate synchronously, wherein the second rotor is capable of rotating relative to the first rotor; and

control means having a control member, the control means varying the radial distance of the control member from the rotation centerline,

wherein the first rotor defines a first hole forming a first track that extends so as to vary its radial distance from the rotation centerline, and the first hole makes contact with the control member that passes through the first track, with the contact between the first hole and the control member occurring at two sides of the first hole toward which the first rotor rotates;

the second rotor defines a second hole forming a second track extending so as to vary its radial distance from the rotation centerline, and making contact with the control member that passes through the second track, with the contact between the second hole

and the control member occurring at two sides of the second hole toward which the second rotor rotates; and

the first track and the second track slant toward each other along the rotational direction of the first rotor and the rotational direction of the second rotor.

2. The valve timing adjustment device according to claim 1, further comprising:

a plurality of the control members,

wherein the first rotor and the second rotor each have a plurality of pairs of the first hole and the second hole arranged along the rotational direction, each pair corresponding to each of the plurality of control members.

3. A valve timing adjustment device provided to a transmission system for transmitting drive torque from a drive shaft of an internal combustion engine to a driven shaft for opening and closing at least one of an air intake valve and an exhaust valve, adjusting the timing at which at least one of the air intake valve and the exhaust valve opens and closes, the device comprising:

a first rotor that rotates around a rotation centerline by the drive torque from the drive shaft;

a second rotor that rotates around the rotation centerline together with the rotation of the first rotor and in the same direction as the first rotor so as to make the driven shaft rotate synchronously and that is capable of rotating relative to the first rotor;

control means having a control member, and varying the radial

distance of the control member from the rotation centerline; and

energizing means for energizing the first rotor and the second rotor to advance one rotor with respect to the rotational direction, and retard the other rotor with respect to the rotational direction,

wherein one of the first rotor and the second rotor has a first wall portion forming a first track extending so as to vary its radial distance from the rotation centerline, the first wall portion making contact with the control member that passes through the first track, with the contact occurring on the retardation side of the first track with respect to the rotational direction;

the other rotor has a second wall portion that forms a second track extending so as to vary its radial distance from the rotation centerline, the second wall portion making contact with the control member that passes through the second track, with the contact occurring on the advancement side of the second track with respect to the rotation direction of its rotor; and

the first track and the second track slant toward each other along the rotational direction of the first rotor and the rotational direction of the second rotor.

4. The valve timing adjustment device according to claim 3, further comprising:

a plurality of the control members,

wherein the first rotor and the second rotor each have a plurality of pairs of the first wall portion and the second wall portion arranged along the rotational direction, with each pair corresponding to each of the plurality of control members.

5. The valve timing adjustment device according to claim 1, wherein the first track and the second track are straight.

6. The valve timing adjustment device according to claim 1, wherein the first track and the second track are curved.

7. The valve timing adjustment device according to claim 6, wherein the first track is formed as an expanded curved line expanding outwardly away from the radial center of the first rotor, and the second track is formed as an expanded curved line expanding outwardly away from the radial center of the second rotor.

8. The valve timing adjustment device according to claim 1, wherein

the first track and the second track intersect each other at a place determined by rotational phase of the second rotor with respect to the first rotor, and

the control member is formed as a bar, and passes through a place of intersection of the first track and the second track.

9. The valve timing adjustment device according to claim 8, wherein the control member has a rolling element both at the place where the control member makes contact with the first rotor, and also at the place where the control member makes contact with the second rotor.

10. The valve timing adjustment device according to claim 1, wherein the control means comprises:

a control member;

a control rotor rotating in the same direction as the first rotor together with the rotation of the first rotor and capable of rotating relative to the first rotor;

torque application means for applying advancement side torque and retardation side torque to the control rotor; and

the control rotor defines a control hole forming a control track extending at a slant with respect to a radial axis line so as to vary its radial distance from the rotation centerline, the control hole making contact with the control member passing through the control track, with the contact occurring on both a radially inward side and a radially outward side of the control hole.

11. The valve timing adjustment device according to claim 1, wherein the control means comprises:

a control member;

a control rotor rotating in the same direction as the first rotor together with the rotation of the first rotor and capable of rotating relative to the first rotor;

torque application means for applying advancement side torque and retardation side torque to the control rotor, and supplementary energizing means for energizing the control member in one radial direction of the control rotor, and

a control wall of the control rotor, the control wall having a control track extending at a slant with respect to a radial axis

line so as to vary the radial distance from the rotation centerline, the control wall making contact with the control member that passes through the control track, where the contact occurs on either a radially inward side or a radially outward side of the control wall.

12. The valve timing adjustment device according to claim 11, wherein the control track is formed as an arc arranged off-center from the rotation centerline.

13. The valve timing adjustment device according to claim 11, wherein the control track is formed in a spiraling pattern.

14. The valve timing adjustment device according to claim 11, wherein the control track is formed straight.

15. The valve timing adjustment device according to claim 14, wherein ends of the control track are formed roughly perpendicular to the radial axis line.

16. The valve timing adjustment device according to claim 15, wherein the control means includes:

holding means for holding a rotational phase of the control rotor with respect to the first rotor at a time when the torque application means is not applying torque to the control rotor.

17. The valve timing adjustment device according to claim 16, wherein the torque application means has an electric motor for

generating torque to be applied to the control rotor.